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# NOTE

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|---|---|---|---|
| DESCRIPTION | Impact Assessment for the proposed cessation of pumping at Sibanye Gold: Ezulwini Mining Company (Pty) Ltd operations | JOB NO. | F925-160 |
| | | DATE | 24 February , 2017 |

## 1. IMPACT ASSESSMENT METHODOLOGY

In order to ensure uniformity, a standard impact assessment methodology will be utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology will be used to describe the impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in **Table 1-1**.

**Table 1-1: Quantitative rating and equivalent descriptors for the impact assessment criteria.**

| RATING | SIGNIFICANCE | EXTENT SCALE | TEMPORAL SCALE |
|---|---|---|---|
| 1 | VERY LOW | *Isolated corridor / proposed corridor* | Incidental |
| 2 | LOW | *Study area* | Short-term |
| 3 | MODERATE | *Local* | Medium-term |
| 4 | HIGH | *Regional / Provincial* | Long-term |
| 5 | VERY HIGH | *Global / National* | Permanent |

A more detailed description of each of the assessment criteria is given in the following sections.

## 1.1 Significance Assessment

Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of area affected by atmospheric pollution may be extremely large (1000km$^2$) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in **Table 1-2** below.

**Table 1-2: Description of the significance rating scale.**

| RATING | | DESCRIPTION |
|---|---|---|
| 5 | VERY HIGH | Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit. |
| 4 | HIGH | Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these. |
| 3 | MODERATE | Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc. |
| 2 | LOW | Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these. |
| 1 | VERY LOW | Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale. |
| 0 | NO IMPACT | There is no impact at all - not even a very low impact on a party or system. |

## 1.2 Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in **Table 1-3**.

**Table 1-3: Description of the spatial rating scale.**

| RATING | | DESCRIPTION |
|---|---|---|
| 5 | Global/National | The maximum extent of any impact. |
| 4 | Regional/Provincial | The spatial scale is moderate within the bounds of impacts possible, and will be felt at a regional scale (District Municipality to Provincial Level). The impact will affect an area up to 50km from the proposed site / corridor. |
| 3 | Local | The impact will affect an area up to 5km from the proposed route corridor / site. |
| 2 | Study Area | The impact will affect a route corridor not exceeding the boundary of the corridor / site. |
| 1 | Isolated Sites / proposed site | The impact will affect an area no bigger than the corridor / site. |

## 1.3 Duration Scale

In order to accurately describe the impact, it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in **Table 1-4**.

**Table 1-4: Description of the temporal rating scale.**

| RATING | | DESCRIPTION |
|---|---|---|
| 1 | Incidental | The impact will be limited to isolated incidences that are expected to occur very sporadically. |
| 2 | Short-term | The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater. |
| 3 | Medium term | The environmental impact identified will operate for the duration of life of the project. |
| 4 | Long term | The environmental impact identified will operate beyond the life of operation. |
| 5 | Permanent | The environmental impact will be permanent. |

## 1.4 Degree of Probability

The probability or likelihood of an impact occurring will be described, as shown in **Table 1-5** below.

**Table 1-5: Description of the degree of probability of an impact occurring.**

| RATING | DESCRIPTION |
|---|---|
| 1 | Practically impossible |
| 2 | Unlikely |
| 3 | Could happen |
| 4 | Very Likely |
| 5 | It's going to happen / has occurred |

## 1.5 Degree of Certainty

As with all studies it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used as discussed in **Table 1-6**. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making. The impacts are discussed in terms of affected parties or environmental components.

**Table 1-6: Description of the degree of certainty rating scale.**

| RATING | DESCRIPTION |
|---|---|
| Definite (Def.) | More than 90% sure of a particular fact. |
| Probable (Prob.) | Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring. |
| Possible (Poss.) | Between 40 and 70% sure of a particular fact, or of the likelihood of an impact occurring. |
| Unsure (Uns.) | Less than 40% sure of a particular fact or the likelihood of an impact occurring. |
| Can't know (CK) | The consultant believes an assessment is not possible even with additional research. |

## 1.6 Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale as described below.

$$\textit{Impact Risk} = \frac{(\text{SIGNIFICANCE} + \textit{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown in **Table 1-7**.

**Table 1-7: Example of Rating Scale.**

| IMPACT | SIGNIFICANCE | SPATIAL SCALE | TEMPORAL SCALE | PROBABILITY | RATING |
|---|---|---|---|---|---|
| | LOW | *Local* | Medium Term | *Could Happen* | |
| Impact to air | **2** | ***3*** | **3** | **3** | **1.6** |

*Note: The significance, spatial and temporal scales are added to give a total of 8, that is divided by 3 to give a criteria rating of 2,67. The probability (3) is divided by 5 to give a probability rating of 0,6. The criteria rating of 2,67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.*

The impact risk is classified according to 5 classes as described in **Table 1-8**.

**Table 1-8: Impact Risk Classes.**

| RATING | IMPACT CLASS | DESCRIPTION - NEGATIVE | DESCRIPTION - POSITIVE |
|---|---|---|---|
| 0.1 – 1.0 | 1 | Very Low | Very Low |
| 1.1 – 2.0 | 2 | Low | Low |
| 2.1 – 3.0 | 3 | Moderate | Moderate |
| 3.1 – 4.0 | 4 | High | High |
| 4.1 – 5.0 | 5 | Very High | Very High |

Therefore, with reference to the example used for air quality above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

## 1.7 Potential Impacts

Please refer to **Table 1-9** for the potential impacts, ratings and mitigatory measures associated with the cessation of pumping at Sibanye Gold: EMC operations. **Table 1-10** lists the impacts associated with the No-Go option.

*Please note that as the independent Environmental Assessment Practitioner, Jones & Wagener (Pty) Ltd (J&W) reserves their right to have calculated quantitative ratings for the impacts listed by specialists that were only discussed qualitatively. J&W has also provided baseline impacts (rating prior to project) for activities where these have not been provided by the specialists.*

*Please note that Jones & Wagener (Pty) Ltd may update the findings and impact assessment in these reports based on the outcomes of the peer reviews of certain specialist reports, as well as authority and Interested and Affected Party review. Any such changes will be brought to the attention of registered Interested and Affected Parties and opportunity will be given to comment on these changes.*

**Table 1-9: Potential impacts, ratings and mitigatory measures associated with the cessation of pumping at Sibanye Gold: EMC operations.**

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Underground Decommissioning / Partial Closure Phase** | | | | | | | | | | | | | |
| Cessation of pumping to the Kleinwes Rietspruit | Surface water quantity | **NEGATIVE IMPACT** Reduction in streamflow which has an impact on surface water users | ▪ There are no proposed mitigation measures for this activity to reduce the negative impact on surface water quantity. | Significance | 5 | High (Positive) | 5 | Very High (Negative) | 0 | Very Low (Negative) | 5 | Very High (Negative) | Definite |
| | | | | Spatial | 4 | | 4 | | 1 | | 4 | | |
| | | | | Temporal | 3 | | 5 | | 1 | | 5 | | |
| | | | | Probability | 5 | | 5 | | 5 | | 5 | | |
| | Surface water quality | **POSITIVE IMPACT** Reduction in salt loads entering the Kleinwes Rietspruit. | ▪ There are no proposed mitigation measures for this activity to reduce the impact on surface water quality. | Significance | 3 | High (Negative) | 3 | High (Positive) | 0 | Very Low (Positive) | 3 | High (Positive) | Probable |
| | | | | Spatial | 4 | | 4 | | 1 | | 4 | | |
| | | | | Temporal | 3 | | 5 | | 1 | | 5 | | |
| | | | | Probability | 5 | | 5 | | 5 | | 5 | | |
| | | **NEGATIVE IMPACT** Increase in Uranium concentration in Peter Wright Dam due to runoff water from wetland area and decrease in dilution effect in the stream, resulting in a | ▪ The artificial wetland area can be rehabilitated to minimise the uranium concentration in the runoff water emanating from the area. | Significance | 3 | High (Positive) | 3 | High (Negative) | 0 | Very Low (Negative) | 3 | High (Negative) | Possible |
| | | | | Spatial | 4 | | 4 | | 1 | | 4 | | |
| | | | | Temporal | 3 | | 5 | | 1 | | 5 | | |
| | | | | Probability | 5 | | 5 | | 5 | | 4 | | |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | reduction in water quality | | | | | | | | | | | |
| | | **NEGATIVE IMPACT**<br>Decrease in dilution effect in the stream, resulting in a reduction in water quality. | ▪ There are no proposed mitigation measures for the decreased dilution effect due to external influences (e.g. anthropogenic influences and urbanisation) to reduce the impact on surface water quality | Significance | 3 | High (Positive) | 3 | High (Negative) | 0 | Very Low (Negative) | 1 | Low (Negative) | Unsure - depends on the effectiveness of the rehabilitation |
| | | | | Spatial | 4 | | 4 | | 1 | | 2 | | |
| | | | | Temporal | 3 | | 5 | | 1 | | 5 | | |
| | | | | Probability | 5 | | 5 | | 5 | | 3 | | |
| Flow from Gemsbok-fontein Eye increasing flow to Wonderfontein spruit | Surface water quantity | **POSITVE IMPACT**<br>Increase in streamflow | ▪ There are no proposed mitigation measures for this activity. | Significance | 0 | No current impact | 2 | Moderate (Positive) | 2 | Moderate (Positive) | 2 | Moderate (Positive) | Definite |
| | | | | Spatial | 0 | | 3 | | 3 | | 3 | | |
| | | | | Temporal | 0 | | 4 | | 4 | | 4 | | |
| | | | | Probability | 0 | | 5 | | 5 | | 5 | | |
| Flowing of aquifer at the Gemsbok-fontein Eye | Surface water quantity | **NEGATIVE IMPACT**<br>Exceedance of the 1 m pipeline capacity. | ▪ Do detailed hydrological study on the catchment to assess the pipeline's capacity.<br>▪ If required and feasible restore pipeline to design capacity | Significance | 0 | No current impact | 2 | Low (Negative) | 2 | Low (Negative) | 0 | No impact | Can't know |
| | | | | Spatial | 0 | | 3 | | 3 | | 0 | | |
| | | | | Temporal | 0 | | 5 | | 5 | | 0 | | |
| | | | | Probability | 0 | | 2 | | 2 | | 0 | | |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ▪ Once water is abstracted from Cooke 1 and Kloof 10 for the WRTRP operations, flow to Donaldson Dam will reduce by approx. 39 Mℓ/day | | | | | | | | | | |
| Flow from Gemsbok-fontein Eye increasing flow to Wonderfontein spruit | Surface water quality | **POSITVE IMPACT** Improvement of water quality | ▪ There are no proposed mitigation measures for this activity to reduce the impact on surface water quality. | Significance | 0 | No current impact | 3 | Moderate (Positive) | 3 | Moderate (Positive) | 3 | Moderate (Positive) | Probable |
| | | | | Spatial | 0 | | 3 | | 3 | | 3 | | |
| | | | | Temporal | 0 | | 4 | | 4 | | 4 | | |
| | | | | Probability | 0 | | 4 | | 4 | | 4 | | |
| Flowing of aquifer at the Gemsbok-fontein Eye | Groundwater flow | **POSITIVE IMPACT** Water flowing again as opposed to the Gemsbokfontein Eye being dry | ▪ N/A | Significance | 2 | High (Negative) | 4 | Very High (Positive) | | | 4 | Very High (Positive) | Probable |
| | | | | Spatial | 4 | | 4 | | | | 4 | | |
| | | | | Temporal | 4 | | 5 | | | | 5 | | |
| | | | | Probability | 5 | | 5 | | | | 5 | | |
| Flowing of aquifer at the Gemsbok-fontein Eye | Groundwater quality | **NEGATIVE IMPACT** Contamination of the water flowing from the eye | ▪ Monitor water quality at the eye.<br>▪ Identify potential pollution sources other than mining. | Significance | 3 | Moderate (Negative) | | | | | 2 | Very Low (Negative) | Probable |
| | | | | Spatial | 4 | | | | | | 1 | | |
| | | | | Temporal | 4 | | | | | | 2 | | |
| | | | | Probability | 3 | | | | | | 1 | | |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ▪ Treat water – only to be considered if significant contamination is observed. | | | | | | | | | | |
| Cessation of pumping to the Kleinwes Rietspruit | Wetlands and Ecology: Kleinwes Rietspruit | **NEGATIVE IMPACT** Changes to downstream vegetation due to lower water levels, resulting in contaminated sediment being transported downstream during rainfall events | ▪ Monitor surface water quality and biodiversity downstream of the EMC and if significant negative impacts are discovered/ contaminants are being transported downstream, remove contaminated sediments | Significance | 3 | Low (Negative) | 4 | Moderate (Negative) | | | 3 | Low (Negative) | Probable |
| | | | | Spatial | 2 | | 3 | | | | 2 | | |
| | | | | Temporal | 3 | | 4 | | | | 3 | | |
| | | | | Probability | 3 | | 3 | | | | 3 | | |
| Cessation of pumping to the Kleinwes Rietspruit | Wetlands and Ecology: Kleinwes Rietspruit | **POSITIVE IMPACT** Potential return of the stream systems and ecology to near pre-mining surface water flows and biodiversity (Should the Peter Wright dam be removed) | ▪ None | Significance | 3 | Low (Negative) | 4 | Moderate (Positive) | | | 4 | Moderate (Positive) | Possible |
| | | | | Spatial | 3 | | 3 | | | | 3 | | |
| | | | | Temporal | 3 | | 4 | | | | 4 | | |
| | | | | Probability | 3 | | 3 | | | | 3 | | |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flowing of aquifer at the Gemsbok-fontein Eye | Wetlands and Ecology: Wonderfront einspruit | **POSITIVE IMPACT** Improvement in water of Wonderfronteins pruit from flow at Gemsbokfontein Eye | ▪ Monitor water quality at Gemsbokfontei n Eye | Significance | 4 | Moderate (Negative) | 2 | Low (Positive) | | | 4 | Low (Positive) | Possible |
| | | | | Spatial | 3 | | 3 | | | | 3 | | |
| | | | | Temporal | 4 | | 3 | | | | 4 | | |
| | | | | Probability | 3 | | 3 | | | | 3 | | |
| EMC Mine Re-Watering causing seepage through the plugs | Flow to adjacent mines (South Deep and Cooke 3) through plugs | **NEGATIVE IMPACT** Water flow into the adjacent mines resulting in increased pumping rates for the receiving mines | ▪ Plug construction according to design<br>▪ Grouting of the rock formations around the plug<br>▪ Continuous plug monitoring (CCTV cameras) | Significance | | No current impact | 5 | Moderate (Negative) | | | 5 | Low (Negative) | Probable |
| | | | | Spatial | | | 3 | | | | 3 | | |
| | | | | Temporal | | | 5 | | | | 5 | | |
| | | | | Probability | | | 3 | | | | 2 | | |
| EMC Mine Re-Watering causing seepage through the pillar | Seepage to adjacent mines (South Deep and Cooke 3) through geological features | **NEGATIVE IMPACT** Water flow into the adjacent mines mine resulting in increased pumping rates for the receiving mines | ▪ Mapping and identification of potential water conduits (faults, dykes)<br>▪ Grouting conduits of groundwater ingress between mines in cases where monitoring shows significant ingress. | Significance | | No current impact | 4 | Moderate (Negative) | | | 2 | Low (Negative) | Possible |
| | | | | Spatial | | | 1 | | | | 1 | | |
| | | | | Temporal | | | 5 | | | | 5 | | |
| | | | | Probability | | | 4 | | | | 3 | | |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ▪ Maintain pumps at 41 level and 33 level in the event of excess seepage, so that re-watering can be controlled. | | | | | | | | | | |
| EMC Mine Re-Watering | Groundwater flow into the EMC mine void | **NEGATIVE IMPACT** Contamination of clean groundwater within the mining void | ▪ Remove as much contaminants from the underground workings as possible.<br>▪ Implement monitoring programme to assess changes to the groundwater table. | Significance | | No current impact | 3 | Moderate (Negative) | | | 3 | Low (Negative) | Definite |
| | | | | Spatial | | | 1 | | | | 1 | | |
| | | | | Temporal | | | 5 | | | | 5 | | |
| | | | | Probability | | | 5 | | | | 3 | | |
| Aquifer Re-Watering | Groundwater Level | **POSITIVE IMPACT** Groundwater level rises and groundwater becomes more accessible again to farmers | ▪ No mitigation required, but groundwater level monitoring is ongoing | Significance | 3 | Moderate (Negative) | 3 | Moderate (Positive) | | | 3 | Moderate (Positive) | Probable |
| | | | | Spatial | 4 | | 2 | | | | 2 | | |
| | | | | Temporal | 3 | | 4 | | | | 4 | | |
| | | | | Probability | 2 | | 5 | | | | 5 | | |
| Aquifer Re-Watering | Groundwater Level | **NEGATIVE IMPACT** Possible influence on | ▪ See below | Significance | | | | | | | | | |
| | | | | Spatial | | | | | | | | | |
| | | | | Temporal | | | | | | | | | |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ground stability and sinkhole formation | | Probability | | | | | | | | | |
| | Groundwater Quality | **NEGATIVE IMPACT**<br>Seepage from the underground workings into the natural environment<br>Seepage from the EMC TSF into the groundwater | ▪ Detailed monitoring<br>▪ Implementation of mitigation measures such as plugging the shaft to contain contamination.<br>▪ Implementation of mitigation measures at the TSF to contain plume migration | Significance | | No impact | 3 | Very Low (Negative) | | | 3 | Very Low (Negative) | Possible |
| | | | | Spatial | | | 2 | | | | 1 | | |
| | | | | Temporal | | | 4 | | | | 3 | | |
| | | | | Probability | | | 1 | | | | 1 | | |
| Seismicity due to re-watering | Risk to plugs and underground workings | **NEGATIVE IMPACT**<br>Damage to infrastructure | ▪ Expert opinion states that risk of damage or destruction of the plugs is negligible<br>▪ Monitoring at EMC until completely re-watered<br>▪ Ongoing monitoring at Cooke 3 and South Deep | Significance | | No impact | 5 | High (Negative) | | | 5 | High (Negative) | Can't know |
| | | | | Spatial | | | 3 | | | | 3 | | |
| | | | | Temporal | | | 5 | | | | 5 | | |
| | | | | Probability | | | 4 | | | | 4 | | |
| | Risk to ground stability | **NEGATIVE IMPACT**<br>Damage to infrastructure | ▪ Expert opinion states that risk of significant ground | Significance | 5 | Moderate (Negative) | 5 | Moderate (Negative) | | | 5 | Very Low (Negative) | Can't know |
| | | | | Spatial | 1 | | 1 | | | | 1 | | |
| | | | | Temporal | 5 | | 5 | | | | 3 | | |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | movement is negligible<br>▪ Ongoing monitoring detailed stability monitoring | Probability | 3 | | 3 | | | | 1 | | |
| Changes in Ground Stability due to re-watering | Ground Subsidence | **NEGATIVE IMPACT**<br>Damage to infrastructure | ▪ Identify areas of potential risk and limit further urban development<br>▪ Ongoing detailed monitoring as subsidence is a slow process<br>▪ Rehabilitation of subsided area or purchase of property as per FWRDWA requirements | Significance | 5 | Moderate (Negative) | 5 | Moderate (Negative) | | | 3 | Very Low (Negative) | Can't know |
| | | | | Spatial | 1 | | 1 | | | | 1 | | |
| | | | | Temporal | 5 | | 5 | | | | 1 | | |
| | | | | Probability | 3 | | 3 | | | | 3 | | |
| | Sinkhole Development<br><br>Loss of life | **NEGATIVE IMPACT**<br>Damage to infrastructure | ▪ Identify areas of potential risk and limit further urban development<br>▪ Current high residential areas developed in safe areas. Most sinkholes | Significance | 5 | Moderate (Negative) | 5 | Moderate (Negative) | | | 3 | Very Low (Negative) | Can't know |
| | | | | Spatial | 1 | | 1 | | | | 1 | | |
| | | | | Temporal | 5 | | 5 | | | | 1 | | |
| | | | | Probability | 3 | | 3 | | | | 3 | | |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | occurred in open field<br>▪ Ongoing detailed monitoring<br>▪ Rehabilitation of sinkholes or purchase of property as per FWRDWA requirements | | | | | | | | | | |
| Cessation of pumping and termination of underground mining | Socio-Economic | **NEGATIVE IMPACT**<br>Direct job and income losses for former employees | ▪ Prioritise affected workers for future employment on Sibanye projects<br>(although most have been redeployed already) | Significance<br>Spatial<br>Temporal<br>Probability | 1<br>3<br>4<br>4 | Moderate (Positive) | 1<br>3<br>4<br>4 | Moderate (Negative) | | | 1<br>3<br>4<br>3 | Low (Negative) | Probable |
| Cessation of pumping and termination of underground mining | Socio-Economic | **NEGATIVE IMPACT**<br>Lower income for local suppliers | ▪ Keep affected suppliers informed of future contracts at Sibanye | Significance<br>Spatial<br>Temporal<br>Probability | 1<br>3<br>4<br>4 | Moderate (Positive) | 1<br>3<br>4<br>4 | Moderate (Negative) | | | 1<br>3<br>4<br>4 | Moderate (Negative) | Probable |
| Cessation of pumping and termination of underground mining | Socio-Economic | **POSITIVE IMPACT**<br>Lower financial losses for Sibanye Gold | ▪ Complete cessation of pumping underground water from Sibanye Gold: | Significance<br>Spatial<br>Temporal<br>Probability | 4<br>3<br>4<br>5 | High (Negative) | 3<br>3<br>4<br>5 | High (Positive) | | | 3<br>3<br>4<br>5 | High (Positive) | Probable |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | EMC operations | | | | | | | | | | |
| Cessation of pumping and termination of underground mining | Socio-Economic | **POSITIVE IMPACT**<br>Higher government income through taxation and mining royalties | ▪ None | Significance<br>Spatial<br>Temporal<br>Probability | <br><br><br> | No impact | 1<br>5<br>4<br>3 | Low (Positive) | <br><br><br> | | 1<br>5<br>4<br>3 | Low (Positive) | Probable |
| Cessation of pumping and termination of underground mining | Socio-Economic | **NEGATIVE IMPACT**<br>Impacts on community safety (due to illegal miners attempting to enter the mine) | ▪ A clear communication strategy to communicate socio-economic impacts of closure to the local community<br>▪ Update of the Emergency Response Plan (Cooke 3 and South Deep)<br>▪ Barricade access to shaft entry points | Significance<br>Spatial<br>Temporal<br>Probability | 5<br>3<br>1<br>4 | Moderate (Negative) | 5<br>3<br>1<br>4 | Moderate (Negative) | <br><br><br> | | 5<br>3<br>1<br>2 | Low (Negative) | Possible |
| Cessation of pumping and termination of underground mining | Socio-Economic | **NEGATIVE IMPACT**<br>Direct income losses for adjacent farmers abstracting water from Kleinwes Rietspruit/Leeus | ▪ Continue engaging in forums in collaboration with local development agents to discuss potential | Significance<br>Spatial<br>Temporal<br>Probability | 3<br>3<br>4<br>4 | Moderate (Positive) | 3<br>3<br>4<br>4 | Moderate (Negative) | <br><br><br> | | 3<br>3<br>4<br>4 | Moderate (Negative) | Possible |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | pruit or being supplied water by EMC, due to water availability | impacts and develop and implement mitigation measures | | | | | | | | | | |
| Cessation of pumping and termination of underground mining | Socio-Economic | **NEGATIVE IMPACT**<br>Direct loss of income for workers in the agricultural sector | ▪ Continue engaging in forums in collaboration with local development agents to discuss potential impacts and develop and implement mitigation measures | Significance<br>Spatial<br>Temporal<br>Probability | 3<br>3<br>4<br>4 | Moderate (Positive) | 3<br>3<br>4<br>4 | Moderate (Negative) | | | 3<br>3<br>4<br>4 | Moderate (Negative) | Possible |
| Cessation of pumping and termination of underground mining | Socio-Economic | **NEGATIVE IMPACT**<br>Income loss for workers at Waterpan Golf Club | ▪ Discussions with Golf Club to discuss potential impacts and develop and implement mitigation measures<br>▪ Possibility to apply for a WUL to pump water form boreholes (3-4km away) | Significance<br>Spatial<br>Temporal<br>Probability | <br><br><br> | No impact | 1<br>3<br>4<br>3 | Low (Negative) | | | 1<br>3<br>4<br>3 | Low (Negative) | Possible |
| | | | | Significance | | No impact | 1 | Low | | | 1 | Low | Possible |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cessation of pumping and termination of underground mining | Socio-Economic | **NEGATIVE IMPACT**<br>Higher club membership costs for Waterpan Club members | ▪ Discussions with Golf Club to discuss potential impacts and develop and implement mitigation measures<br>▪ Possibility to apply for a WUL to pump water form boreholes (3-4km away) | Spatial | | | 3 | (Negative) | | | 3 | (Negative) | |
| | | | | Temporal | | | 4 | | | | 4 | | |
| | | | | Probability | | | 3 | | | | 3 | | |
| Cessation of pumping and termination of underground mining | Socio-Economic | **NEGATIVE IMPACT**<br>Potential flooding of adjacent mines due to plug failures<br>(Expert opinion states that risk of damage or destruction of the plugs is negligible) | ▪ Monitoring of plug integrity and water level at EMC until completely re-watered<br>▪ Ongoing monitoring at Cooke 3 and South Deep plugs and boundary pillars by CCTV<br>▪ Emergency Response Plans developed for South Deep and Cooke 3. | Significance | | | 5 | Very Low (Negative) | | | 5 | Very Low (Negative) | Unsure |
| | | | | Spatial | | | 3 | | | | 3 | | |
| | | | | Temporal | | | 5 | | | | 5 | | |
| | | | | Probability | | No impact | 1 | | | | 1 | | |
| | | | | Significance | 5 | Moderate | 5 | Moderate | 5 | Moderate | 4 | Low | Unsure |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cessation of pumping and termination of underground mining | Socio-Economic | **NEGATIVE IMPACT**<br>Risks related to dolomitic instability | ▪ Sibanye to develop transparent communication strategy to inform local community and municipality of risks and events<br>▪ As per groundwater and seismic impact specialist's reports<br>▪ Identify areas of potential risk and limit further urban developme nt<br>▪ Ongoing detailed monitoring and subsidenc e is a slow process | Spatial | 3 | (Negative) | 3 | (Negative) | 3 | (Negative) | 3 | (Negative) | |
| | | | | Temporal | 3 | | 3 | | 3 | | 3 | | |
| | | | | Probability | 3 | | 3 | | 3 | | 3 | | |
| Cessation of pumping and termination of | Socio-Economic | **POSITIVE IMPACT**<br>Lower external costs due to | ▪ None | Significance | 1 | Low (Negative) | 1 | Low (Positive) | | | 1 | Low (Positive) | Probable |
| | | | | Spatial | 5 | | 5 | | | | 5 | | |
| | | | | Temporal | 4 | | 4 | | | | 4 | | |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Rating prior to mitigation (Additional Impact) | | Cumulative rating | | Rating post mitigation (Residual Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| underground mining | | reduced electricity consumption | | Probability | 3 | | 3 | | | | 3 | | |

**Table 1-10: Potential impacts, ratings and mitigatory measures associated with the no-go option.**

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|
| Continued pumping to the Kleinwes Rietspruit | Surface water quantity | **POSITIVE IMPACT** Streamflow remains constant | ▪ N/A | Significance | 5 | High (Positive) | Definite |
| | | | | Spatial | 4 | | |
| | | | | Temporal | 3 | | |
| | | | | Probability | 5 | | |
| | Surface water quality | **NEGATIVE IMPACT** Salt loads entering the Kleinwes Rietspruit. are not reduced. | ▪ N/A | Significance | 3 | High (Negative) | Probable |
| | | | | Spatial | 4 | | |
| | | | | Temporal | 3 | | |
| | | | | Probability | 5 | | |
| | | **POSITIVE IMPACT** No decrease in dilution effect in the stream. | ▪ N/A | Significance | 3 | High (Positive) | Probable |
| | | | | Spatial | 4 | | |
| | | | | Temporal | 3 | | |
| | | | | Probability | 5 | | |
| | | **POSITIVE IMPACT** No increase in Uranium concentration | ▪ N/A | Significance | 3 | High (Positive) | Definite |
| | | | | Spatial | 4 | | |
| | | | | Temporal | 3 | | |
| | | | | Probability | 5 | | |
| No flowing of aquifer at the Gemsbok-fontein Eye | Surface water flow | **NEGATIVE IMPACT** Gemsbokfontein Eye remaining dry | ▪ N/A | Significance | 2 | High (Negative) | Probable |
| | | | | Spatial | 4 | | |
| | | | | Temporal | 4 | | |
| | | | | Probability | 5 | | |
| No flowing of aquifer at the | Surface water quality | **NEGATIVE IMPACT** | ▪ N/A | Significance | 3 | Moderate (Negative) | Probable |
| | | | | Spatial | 4 | | |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|
| Gemsbok-fontein Eye | | No dilution effect on the Wonderfonteinspruit | | Temporal | 4 | | |
| | | | | Probability | 3 | | |
| Continued pumping to the Kleinwes Rietspruit | Wetlands and Ecology: Kleinwes Rietspruit | **NEGATIVE IMPACT** Downstream vegetation remains in place, preventing excessive contaminated sediment transport downstream | ▪ N/A | Significance | 3 | Low (Negative) | Probable |
| | | | | Spatial | 2 | | |
| | | | | Temporal | 3 | | |
| | | | | Probability | 3 | | |
| Continued pumping to the Kleinwes Rietspruit | Wetlands and Ecology: Kleinwes Rietspruit | **NEGATIVE IMPACT** Not returning the stream systems and ecology to that of pre-mining surface water flows and biodiversity | ▪ N/A | Significance | 3 | Low (Negative) | Possible |
| | | | | Spatial | 3 | | |
| | | | | Temporal | 3 | | |
| | | | | Probability | 3 | | |
| No flowing of aquifer at the Gemsbok-fontein Eye | Wetlands and Ecology: Wonderfronteins pruit | **NEGATIVE IMPACT** No improvement in water of Wonderfronteinspruit as no dilution from flow at Gemsbokfontein Eye | ▪ N/A | Significance | 4 | Moderate (Negative) | Possible |
| | | | | Spatial | 3 | | |
| | | | | Temporal | 4 | | |
| | | | | Probability | 3 | | |
| No aquifer Re-Watering | Groundwater Level | **NEGATIVE IMPACT** Groundwater level remains inaccessible to farmers | ▪ N/A | Significance | 3 | Moderate (Negative) | Probable |
| | | | | Spatial | 4 | | |
| | | | | Temporal | 3 | | |
| | | | | Probability | 2 | | |
| Seismicity | Risk to ground stability | **NEGATIVE IMPACT** Damage to infrastructure | ▪ N/A | Significance | 5 | Moderate (Negative) | Can't know |
| | | | | Spatial | 1 | | |
| | | | | Temporal | 5 | | |
| | | | | Probability | 3 | | |
| Ground Stability | Ground Subsidence | **NEGATIVE IMPACT** Damage to infrastructure | ▪ N/A | Significance | 5 | Moderate (Negative) | Can't know |
| | | | | Spatial | 1 | | |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|
| | | | | Temporal | 5 | | |
| | | | | Probability | 3 | | |
| | Sinkhole Development | **NEGATIVE IMPACT** Damage to infrastructure | ▪ N/A | Significance | 5 | Moderate (Negative) | Can't know |
| | | | | Spatial | 1 | | |
| | | | | Temporal | 5 | | |
| | | | | Probability | 3 | | |
| Continued pumping and underground mining | Socio-Economic | **POSITIVE IMPACT** No direct job or income losses for employees | ▪ N/A | Significance | 1 | Moderate (Positive) | Probable |
| | | | | Spatial | 3 | | |
| | | | | Temporal | 4 | | |
| | | | | Probability | 4 | | |
| Continued pumping and underground mining | Socio-Economic | **POSITIVE IMPACT** Sustained income for local suppliers | ▪ N/A | Significance | 1 | Moderate (Positive) | Probable |
| | | | | Spatial | 3 | | |
| | | | | Temporal | 4 | | |
| | | | | Probability | 4 | | |
| Continued pumping and underground mining | Socio-Economic | **NEGATIVE IMPACT** Continued financial losses for Sibanye Gold | ▪ N/A | Significance | 4 | High (Negative) | Probable |
| | | | | Spatial | 3 | | |
| | | | | Temporal | 4 | | |
| | | | | Probability | 5 | | |
| Continued pumping and underground mining | Socio-Economic | **NEGATIVE IMPACT** Impacts on community safety | ▪ N/A | Significance | 5 | Moderate (Negative) | Possible |
| | | | | Spatial | 3 | | |
| | | | | Temporal | 1 | | |
| | | | | Probability | 4 | | |
| Continued pumping and | Socio-Economic | **POSITIVE IMPACT** | ▪ N/A | Significance | 3 | Moderate (Positive) | Possible |
| | | | | Spatial | 3 | | |

| Activity | Aspect | Impact | Mitigation | Criteria | Rating prior to project (Initial Impact) | | Certainty of rating |
|---|---|---|---|---|---|---|---|
| underground mining | | No income losses for adjacent farmers due to water availability | | Temporal | 4 | | |
| | | | | Probability | 4 | | |
| Continued pumping and underground mining | Socio-Economic | **POSITIVE IMPACT**<br>No loss of income for workers in the agricultural sector related to the EMC operations | ▪ N/A | Significance | 3 | Moderate (Positive) | Possible |
| | | | | Spatial | 3 | | |
| | | | | Temporal | 4 | | |
| | | | | Probability | 4 | | |
| Continued pumping and underground mining | Socio-Economic | **NEGATIVE IMPACT**<br>Risks related to dolomitic instability | ▪ N/A | Significance | 5 | Moderate (Negative) | Unsure |
| | | | | Spatial | 3 | | |
| | | | | Temporal | 3 | | |
| | | | | Probability | 3 | | |
| Continued pumping and underground mining | Socio-Economic | **NEGATIVE IMPACT**<br>High external costs due to sustained high electricity consumption | ▪ N/A | Significance | 1 | Low (Negative) | Probable |
| | | | | Spatial | 5 | | |
| | | | | Temporal | 4 | | |
| | | | | Probability | 3 | | |